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FOREST PLANTING LEAFLET.

SHORTLEAF PINE (*Pinus echinata*).

FORM AND SIZE OF TREES GROWN IN PLANTATIONS.

Shortleaf pine, which is also commonly called "forest," "yellow," or "rosemary" pine, is the most important conifer in the Piedmont or red-clay hill region of the Southern States, where its second growth is the common old-field pine. Trees grown in plantations will have the same form and reach the same size as the trees in the best old-field stands. On the best soil its second growth attains in eighty years a maximum height of from 90 to 100 feet and a diameter of from 20 to 24 inches. Ordinarily, however, the size of the tree in old-field stands, especially east of the Mississippi River, is much less, its height usually being from 75 to 85 feet and its diameter from 12 to 16 inches. The mature tree in a second-growth stand has a moderately tapering, straight or slightly crooked stem, which is clear of branches for from one-half to two-thirds its length and ultimately divides near the top of the tree into several branches. The thin-foliaged crown, formed of short, slender branches, is oval or irregular in outline. The bark, bright reddish brown and firm, is divided by deep furrows into regular oval or rectangular plates, and is much thickened at the base of the stem, where it is usually from $1\frac{1}{2}$ to 2 inches thick.

PLANTING RANGE.

The planting range of shortleaf pine embraces its natural range and a considerable territory beyond to the north and west. It is the characteristic pine of the southern Piedmont and foothills, being

most abundant at middle altitudes—that is, between 500 and 2,000 feet—and in plantations can be expected to succeed best within these limits of altitude and in this region. In New Jersey and southeastern Pennsylvania it is rare, but is desirable for planting on soils too dry for white pine. Farther south, in the rolling plateau region, it is very common, and it is suitable for planting on all upland soils. Its distribution lies largely to the north and west of that of loblolly and longleaf pines, and consequently it is infrequent in the coastal plain south of the Roanoke River, although, mixed with longleaf pine and hard woods, it is occasionally found on bluffs and banks as far east as the south Atlantic coast and as far south as northern Florida and to points well within the coastal plain in Mississippi, Louisiana, and Texas. In northern Mississippi it occurs in large isolated bodies, becoming less common northward through Tennessee and Kentucky, and finding its northern limits west of the Alleghenies in southern Ohio and southern Indiana. It is seldom found in the Mississippi Delta region and is not recommended for planting there. West of the Mississippi it extends to southwestern Missouri and eastern Oklahoma, and south to the Sabine River in Texas, reaching its best development in northwestern Louisiana, Arkansas, southwestern Missouri, and northeastern Texas, where its forests, nearly pure, at one time covered thousands of square miles. East of the Mississippi the pure stands of young growth in old fields cover many thousands of acres. Throughout the entire area of its distribution it is one of the most desirable conifers for planting on suitable sites outside of its natural range, and it can be recommended for planting on suitable soils in southern New England, southern New York, southern and eastern Ohio, southern Illinois, Indiana, Missouri, and eastern Kansas. It is not suitable for planting on sandy soils of the coastal plain or above 1,000 feet altitude in Pennsylvania, 1,500 feet in West Virginia, or 2,000 feet in North Carolina and Tennessee.

SOIL REQUIREMENTS.

Shortleaf pine requires a deep and thoroughly drained soil, which must not be too sandy. It is not suited for planting on bottom land or on flat, poorly drained uplands. On shallow soils it attains only small size. Thoroughly drained soils such as occur on hills and slopes afford most congenial sites for plantations.

USES OF THE WOOD.

The wood of shortleaf pine is soft, light, straight-grained, and easily worked. The heartwood, which usually forms about one-half of the volume of trees more than 14 inches in diameter, is light brownish yellow, or orange, durable on exposure, and will not warp.

The sapwood, which forms the greater part of the second-growth trees less than 14 inches in diameter, is lighter in color, is not durable on exposure to the weather, and is prone to warp and check. The wood of trees in plantations will be similar to that of the old-field second-growth trees, which is more knotty and coarser grained than that of original growth, but its quality will be greatly affected by the care which is given the plantation. Well-stocked stands which are regularly thinned will produce clearer wood than neglected stands.

The better grades of shortleaf pine lumber are used extensively for building material of all kinds, and in the region of its growth it is used in preference to the wood of other species. The poorer grades and sapwood are principally used for low-grade lumber, box boards, slack cooperage, ties, fuel, and similar uses.

PLANTATIONS.

The growth of the seedlings is rapid and the young plants are so hardy and vigorous that plantations can be started by direct seeding, instead of by transplanting, as is necessary with slower growing trees.

If the land to be planted is cleared, shallow furrows can be laid off 5 feet apart, and seed planted at intervals of 5 feet in the furrow. If the land has merely been logged over or has many sprouts and shrubs on it which would interfere with plowing, the soil should be loosened with a mattock in spots 8 or 10 inches square and 5 feet apart, and the seed planted in these spots. There are about 50,000 seed to a pound, but the percentage of sound seed seldom exceeds 20. Not less than 10 or 15 seeds should, therefore, be dropped into each hole; the covering of earth should not be deeper than one-half inch. To prevent squirrels, mice, and birds from eating the seed, it should be coated with a thick mixture of red lead and water. No cultivation is necessary.

Plantations can also be established by means of seedlings. Two-year-old plants, either seedlings or one-year-old transplants, which are stouter, should be used. They should be from 5 to 8 inches high. The seedbed for growing seedlings should be made in fertile, well-drained soil, and the seed planted in the autumn or early spring, thinly scattered in drills about 6 inches apart. One pound of seed should be sufficient for 400 feet of drill. If the seed is planted in the autumn the seedbed should be protected from mice and birds; if planting is delayed until spring some of the seed may lie over for a year without germinating. The cost of raising two-year-old seedlings in large numbers should not be more than \$2.50 a thousand; of transplants of the same age \$4.50 a thousand. The seedbeds should be lightly shaded during the first summer. Seedlings are not subject to damping off.

The roots of plants when lifted from the seedbed for planting should be protected from the air by wet cloths, and in addition it is desirable to puddle the roots by dipping them in thick mud. Planting can be most rapidly done by two men, one digging the holes with a mattock and the other following with the seedlings and planting them. The cost of planting should be about \$4 a thousand or \$4.80 an acre for trees spaced 6 by 6 feet. The young seedlings are hardy and reasonably free from disease, but must be carefully protected from fire until the trees are several inches in diameter and the bark thick enough for protection.

Stands are much benefited by thinnings, which should remove all crooked, defective, dead, and most of the crowded trees. Enough of the crowded trees, however, should be left to insure the development of the larger trees. The first thinning should be made when the stand is between 15 and 20 years old, if the material removed at that time can be used for firewood. Subsequent thinnings should be made at intervals of not more than 10 years, and preferably at intervals of from 3 to 6 years.

YIELD OF PLANTATIONS.

The old-field stands of shortleaf pine furnish reliable means of ascertaining the yield of plantations. The rate of growth of shortleaf pine in such stands is somewhat slower than that of loblolly pine, but more rapid than that of longleaf in similar stands. In old-field stands the growth of the larger, or dominant, trees is much faster, especially in diameter, than that of the smaller, suppressed, and crowded trees. On good soils these larger trees will reach a diameter of 12 inches at breast height in forty years. In crowded, unthinned stands the yield will be about 6,000 board feet to the acre at forty years, 13,000 at fifty years, and 17,000 at sixty years. If these stands are thinned by the periodic removal of the smaller trees their yield can be increased to 8,400 board feet at thirty years, 16,000 feet at forty years, and 20,000 feet at fifty years.

Shortleaf pine may be planted in mixture with southern red oak, black locust, or red cedar. In making such plantations it would be necessary to use the more costly seedling plants. Locust and cedar need not be cut until the later thinnings are made, when they can be used for fence posts; the red oak might profitably be left to form a part of the mature stand.

Approved.

W. M. HAYS,

Acting Secretary of Agriculture.

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